

# An Ecological Cause for Evolutionary Changes in Bird Brains

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When organisms change lifestyles, they encounter a different environment. These new conditions may select for better adapted individuals. For instance, animals dependent on vision, might need to develop other senses during night activity. A species of nocturnal/crepuscular bird could show adaptations making it better suited than its diurnal ancestors to life at night. Healy and Guilford (1990) demonstrated the evolutionary development of the olfactory bulb in birds is related to activity during low-light conditions. This increased olfactory sensitivity may compensate for the light-limited vision.

Relative smelling abilities of birds can be determined by comparing the olfactory-bulb portion of the brain. Olfactory-bulb size is, of course, related to both body and brain size, and these effects must be eliminated for valid comparisons. In addition to removing these dependencies, Healy and Guilford also canceled taxonomic effects by comparing olfactory-bulb sizes at the family level. Avian families were divided into a diurnal group and a nocturnal/crepuscular group. They then compared relative olfactory-bulb size between these two groups. Splitting at the family level allows comparisons of divergent evolutionary lines with a minimum of taxonomic interferences.

Healy and Guilford looked at several potential causes for this development of smell. Other researchers have suggested several ecological variables to explain the considerable variation in avian olfactory-bulb sizes: diet, nest type, development, nest dispersion, and migratory behavior. Healy and Guilford examined all of these, plus activity timing (diurnal versus nocturnal/crepuscular lifestyles). Of the 6 ecological variables inspected, only activity timing accounted significantly for the variation in olfactory-bulb size. The other factors were not significant when using a family-level comparison. Furthermore, when comparing 13 evolutionarily independent group pairs, 12 showed larger olfactory bulbs in nocturnal/crepuscular birds than their diurnal counterparts.

Therefore, the ecological factor of light-level conditions may cause evolutionary development of the olfactory bulb in bird brains. Species once adapted to daytime activity evolved a better sense of smell when they moved to night conditions. This enhanced sense could compensate for the visual sense decrease due to activity in low light levels.

## Literature Cited

Healy, S., and T. Guilford. 1990. Olfactory-bulb size and nocturnality in birds. *Evolution* 44(2):339-346.